CLEMSON

IMPACTS

Listening when fields talk

CLEMSON UNIVERSITY PUBLIC SERVICE & AGRICULTURE - SPRING 2014

COOPERATIVE EXTENSION 1914-2014 100 SMITH-LEVER ACT EXTENDING KNOWLEDGE CHANGING LIVES CLEMSON UNIVERSITY

A century of service
Tracking plant invaders
A crop revival
Bringing Food to Market

Vice President's Message

When they reach 100, most centenarians can take a well-deserved moment to reflect on past accomplishments.

Some will look forward to the next hundred years.

Such is the case with the Cooperative Extension Service.

The concept of taking research-based knowledge from colleges and universities and putting it in the hands of working people - a revolutionary idea when Extension was founded - marks its hundredth birthday this year. And in the state of its birth - South Carolina - Extension is firmly facing forward to a new century of helping people improve their lives and their livelihoods.

Created in 1914, by the pen strokes of South Carolina congressman Frank Lever - a Clemson trustee and chairman of the House agriculture committee - and Georgia Senator Hoke Smith, Extension's roots grow deep in the Palmetto State.

It was conceived in the tomato demonstration clubs of the Lowcountry and in the trains that took Clemson agriculture professors across the state to teach farmers and their families the best practices for growing crops, preserving food and safeguarding the land.

In the century since, Extension has shared the wealth of the nation's knowledge in agriculture, natural resources, food safety and nutrition, economic and community development, and 4-H youth development with the people who needed it most. The productivity of American agriculture rose right along with that mission, and the process continues in very much the same way today. You'll see it in the pages of this newsletter, as Extension specialists and county agents teach new, more cost-effective ways to fight diseases in strawberries, to diversify farming with profitable crops, and to produce and market food products to consumers.

Son of a Lexington County farmer - ironically, not far from the strawberry field on the cover of this magazine - Frank Lever knew the importance of building a strong agricultural infrastructure. He devoted his life to it.

Today as in Lever's day, agriculture remains our state's largest industry. Thanks to Frank Lever - and to the many professionals who have taken the torch to generations since - agriculture's future looks just as bright as ever in the next century.

Sincerely,
George Askew
Vice President for Public Service and Agriculture

Celebrate the centennial: www.clemson.edu/100

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Fields help farmers fight fungus

By Tom Hallman

The fertile, rolling fields of Lexington County have sustained farm families for generations. Many of these fields yield the succulent strawberries that are a staple of spring and summer in the South.

Until now, though, the fields rarely talked back to their farmers.

At least one Lexington County strawberry field is doing just that. And if Clemson Extension agent Powell Smith has his way, more will follow, because what those fields have to say can save farmers a bundle of money.

"Deciding when to spray fungicides is not always an easy call," Smith explains. "You don't want to spray unnecessarily, but you don't want to let the problem go untreated either. The better information the farmer has, the better decision he can make."

The fields themselves can provide much of that information – if they're equipped to do so. That's why Smith engaged the help of strawberry farmer Mike Keisler in a research project that stretches from Lexington across the Southeast.

Keisler allowed Clemson scientists to erect a compact weather station perched atop a metal post in one of his fields. "Mike donated one acre to spray based on what the weather station tells him. The rest of the field he sprays as he always has," Smith said.

Solar-powered and Internet-enabled, the station can monitor and report conditions in the field that favor the development of gray mold, a scourge of strawberries. It measures wind speed, temperature, humidity and the amount of solar radiation. It also detects leaf moisture, an essential condition for the disease.

A wi-fi connection uploads the data to computers at Clemson, where it falls under the watchful eye of Guido Schnabel, an Extension plant pathologist and state specialist for fruit diseases.

"The goal is to reduce the number of applications needed to fight diseases," Schnabel said. "In a normal year, we're able to reduce it by 50 percent."

Keisler's results were even better. In a year in which he would've made 14 fungicide applications, the research plot required only four.

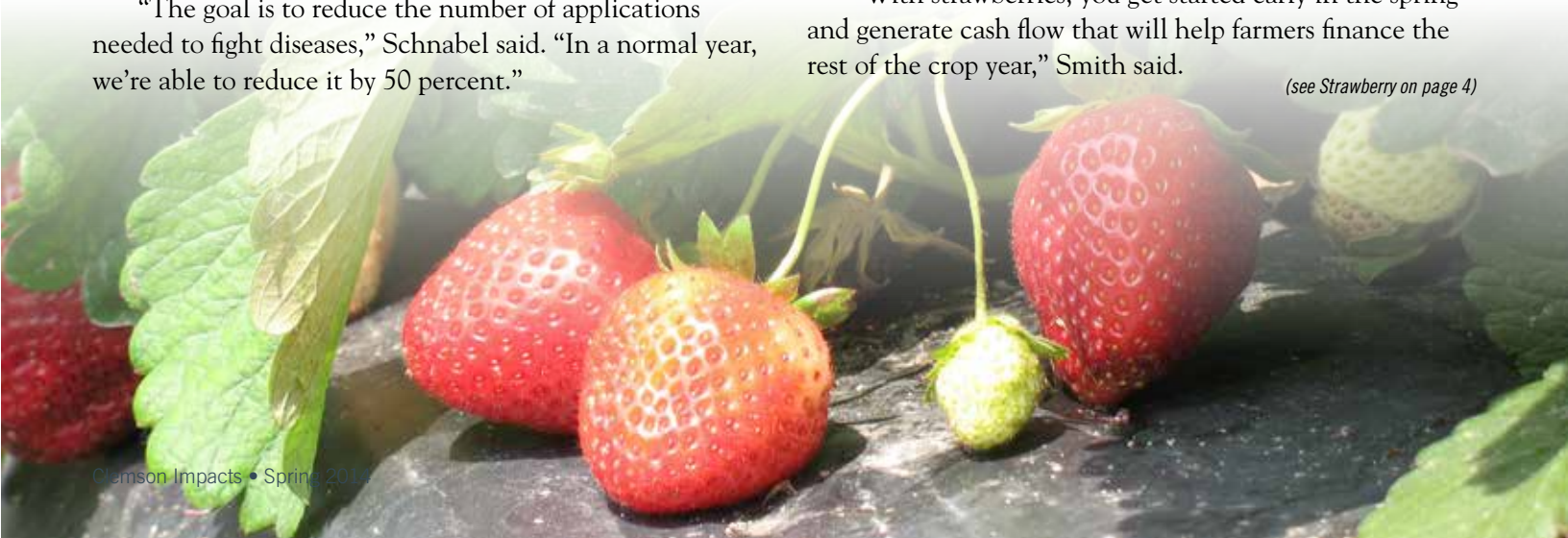
The research ultimately may benefit farms and crops across the country, but it's particularly important here and now, Smith said.

Gray mold is caused by a fungus whose scientific name, Botrytis cinerea, stems from the ancient Greek word for grapes, on whose moisture it has fed since time immemorial. But it can be especially serious and damaging to soft fruits like strawberries.

That's anathema to Smith, who knows that strawberries are a high-value crop for small farmers in the Midlands. The second most valuable fruit crop in South Carolina behind peaches, strawberries here are grown overwhelmingly for fresh consumption – mostly on patches of just two acres.

"With strawberries, you get started early in the spring and generate cash flow that will help farmers finance the rest of the crop year," Smith said.

(see Strawberry on page 4)



(**Strawberry** *from page 3)*

As much as farmers depend on the research and advice of Clemson agriculture professionals, Clemson depends on farmers like Keisler, Smith said.

"In 18 of 20 years I've been here, he's had a test plot on this farm," Smith said. "We depend on the farm operators. And they trust this kind of research – performed in a field they know."

The research is part of a regional project based at the University of Florida and funded by a USDA National Institute of Food and Agriculture grant.

Its benefit extends beyond saving individual farmers money on sprays. In the long run the research may be even more important to the nation's strawberry crop as a whole. That's because, over time, some diseases of strawberries have become resistant to the very chemicals farmers use to control them.

"There are seven different classes of chemical and each chemical class has several products," Schnabel said. "There's not a single class where we don't have a resistance problem."

As part of the research, Schnabel and his colleagues have developed a kit that enables farmers to determine the level of fungicide resistance they face.

"It's very important the grower knows what still works in his location," Schnabel said. "In four days we can tell the grower if there is a resistance problem and tell which of the classes of pesticide will work best for them.

"Ultimately, we want to use fewer sprays and more effective sprays – to spray less, and spray the right thing."

Learn more about Clemson Extension horticulture programs: www.clemson.edu/extension/horticulture/

See video and interviews with Powell Smith & Mike Keisler: www.clemson.edu/public/psatv/ag/weather-reports-fungi.html

Watch video of Guido Schnabel's profile kit: www.clemson.edu/public/psatv/ag/strawberry-kit.html

South's top farmer aids Clemson research efforts

By Tom Hallman

In agriculture, the headlines usually go to the big-dollar, big-acre row crops.

So when the South's largest farm show proclaimed a peach and berry farmer its 2013 Farmer of the Year, it's a fair to ask what James Cooley did right.

Pretty much everything, if you ask his county agent.

"His is truly a family farm," said Andy Rollins, Clemson Extension agent in Spartanburg County who works with fruit and vegetable farmers across the Upstate. "James inherited military discipline from his father. His appreciation for people is what makes him successful."

Working with his wife, daughters and employees – nearly 200 during the peak harvest season – Cooley farms more than 1,100 acres of peaches, strawberries and blackberries near Chesnee. Dubbed "Strawberry Hill U.S.A.," Cooley calls the farm "a little piece of heaven on earth."

It's also an important part of Clemson's research and Extension efforts in horticulture. Cooley has volunteered his property and his time to help Clemson conduct a number of research projects, including a sister weather station to the gray mold research being done on Mike Keisler's Lexington County Strawberry farm.

"James has helped us with variety trials and virus studies," Rollins said. "He fertilizes, prunes, and maintains pest control on this entire block of trees for our research use. He sees the long-term impact of this kind of work, not only to his own farm, but also to keeping the state's entire industry sustainable and financially competitive."

That vision led to Cooley's selection as the Swisher Sweets/Sunbelt Expo Southeastern Farmer of the Year award for 2013. The award recognizes excellence in agricultural production and farm management, along with leadership in farm and community organizations.

"Our success is due to many people who have believed in our ideas and dreams," Cooley said. "My mother and father taught me to value every customer, whether they buy a small bag or a trailer load. We believe strongly in South Carolina taste and quality."

Learn more about Clemson Extension fruit and vegetable programs: www.clemson.edu/extension/horticulture/fruit_vegetable

Visit Strawberry Hill online: www.strawberryhillusa.com

Investigators bide their time to catch invasive weeds

By Tom Hallman

They can hide, but they can't run.

Winter covered the tracks of a pair of plant pests that invaded South Carolina last fall, but Clemson investigators will be waiting for them when they emerge in the spring.

"In the winter as plants die back, it's impossible to identify them," said Christel Harden, who leads the plant pest detection and nursery inspection efforts for Clemson's Department of Plant Industry (DPI). "Once these invasive plants begin to grow again, we'll be better able to determine the extent of their spread and try to eradicate them."

The pair of pests appeared in the Palmetto State shortly before going dormant for the winter. Both present potential problems for important agricultural crops and are regulated by state and federal governments as noxious weeds.

The debut of Benghal dayflower, first reported by Lowcountry botanist and nurseryman Daniel Payne, led DPI investigators to conduct a house-to-house survey for the weed in November, concentrating on waterfront neighborhoods where the weed first appeared.

News reports on the weed's discovery prompted homeowners to report two other infestations, since confirmed in St. Matthews and near Rowesville in Orangebug County.

Benghal dayflower – which bears the alias "tropical spiderwort" and an official name of Commelina benghalensis – grows a dense stand that can smother other plants. It is a particularly damaging pest of row crops like soybeans, peanuts and corn, which combined generate about $500 million in farm receipts in South Carolina, according to the National Agricultural Statistics Service.

Harden said the department is still investigating how the weed found its way to the Palmetto State – possibly among container plants or seed carried by birds. This is the first time the weed has been found in the state outside of a plant nursery. Regulators found Benghal dayflower in a container of liriope at a South Carolina nursery in 2005, where it was destroyed.

Itchgrass, a tall Asian grass that lives up to its name, was identified in Moncks Corner in October, the first documented South Carolina detection of the pest. A second suspected case has since been reported in Spartanburg County.

"The diverse locations could indicate that it was a hitchhiker," Harden said. "Itchgrass seeds often attach to road construction equipment and farm machinery, depositing themselves along highways and railroads."

The thick, fast-growing grass, which can grow 10 feet high if left unchecked, chokes out native species. Thought to have made its way to the United States on railroad cars from Latin America, it now infests the Gulf Coast states.

"At first glance it looks very much like Johnson grass, but there are sharp, irritating hairs along its spine," Harden said. "It will show itself again in the spring and we'll know the extent of the infestation. Then we'll determine how best to manage it."

The Department of Plant Industry conducts certification and inspection programs related to plant nurseries and enforces state laws and regulations that protect the state from exotic and invasive species.

It is part of Clemson's Regulatory Services branch, which includes departments that regulate pesticides and structural pest control, verify that fertilizer and lime meet standards and labeled guarantees, conduct seed and organic certification programs, diagnose plant pests, and ensure readiness to respond to catastrophic events impacting the state's agriculture.

Learn more about Clemson's Invasive Species Program: www.clemson.edu/invasives

Scientists investigate biological tolerance for arsenic

By Peter Kent

What you don't know could kill you. Take arsenic, for example. Even nonfatal levels of the deadly poison can make people sick, and the chemical has been linked to brain development problems in children and cancers in adults.

That's why the killifish has taken an important role in a Clemson biology study. A small, hardy and prolific fish, the killifish is serving as a scientific model for the effects of arsenic on early stages of growth.

Clemson biologist Lisa Bain is conducting the research, funded by the Clemson Experiment Station. And her research indicates that even low percentages of the poison harm killifish.

"At fairly low levels, arsenic appears to cause reduced muscle fiber density in young killifish," Bain said. "Born with fewer numbers of fast-twitch muscle fibers, they are weaker and unable to swim fast, which affects their ability to capture food and escape becoming prey."

That weakened muscle condition can be passed from one generation to the next, she said.

Her study results suggest that current levels of arsenic tolerance set by the government may need to change, Bain said. That's especially important to South Carolina, which is one of eight states that the U.S. Environmental Protection Agency says have higher-than-average arsenic concentrations in the water.

"The levels currently set by government should be reviewed and research supports revising them to lower levels in drinking water," Bain said.

Learn more about work at the Clemson Experiment Station:
www.clemson.edu/public/experiment_station

Research goes whole-hog into feral swine problem

By Jonathan Veit

When Spanish explorer Hernando de Soto rowed ashore near present-day Tampa in 1540, he hauled along a drove of pigs as a gift to Native American chiefs.

Today, de Soto's offer of succulent swine has turned curse as feral hogs are overrunning the Southeastern states.

"Studies show that invasive feral hogs cause an estimated $120 billion per year of economic damage in the United States, but we have almost no data on the economic or ecological damage they are causing in South Carolina," said Kate McFadden, a Clemson wildlife ecologist.

McFadden and a team of Clemson researchers are surveying landowners to quantify the amount of damage and determine what counties are hardest hit.

They're collaborating with the South Carolina Department of Natural Resources, USDA Wildlife Service and South Carolina Farm Bureau to help craft effective management strategies and educate farmers and landowners about the pests.

"Feral hogs are the No. 1 wildlife problem facing the state of South Carolina," said Marion Barnes, senior Clemson Extension agent for Colleton and Hampton counties. "In addition to the tremendous amount of damage they are causing crops and timber, they are also turning up in urban and suburban neighborhoods throughout South Carolina and the Southeast."

Researchers are working with selected landowners in feral hog "hotspots" to implement and test the effectiveness of a remote infrared-triggered camera and trap system.

The idea is to enhance the ability to detect and monitor feral hogs and assess damage. Clemson students already have tested the camera trap system in the university's experimental forest.

Landowners also can report wild hog sightings through Extension's South Carolina Wild Hog Task Force website.

The study will be among the first to assess both economic and ecological damage, such as the spread of disease and destruction of habitat for other wildlife.

"It's a yearly battle," said Allendale County farmer Mark Connelly. "One year I planted 93 acres of corn on a Saturday. By Wednesday night, the hogs had covered the whole field."

Trapping followed by euthanasia is the conventional method of management, but there is debate about which baits, trap designs and strategies are most effective.

McFadden said that hogs' early age of sexual maturity, ability to breed multiple times per year, large litter sizes and long life span means that more must be done to control their numbers.

Learn more about the South Carolina Wild Hog Task Force:
www.clemson.edu/extension/natural_resources/wildlife/wildhogs

Next generation of farmers is already at work in state FFA, college and Extension programs

By Tom Hallman

Before you can grow a crop, you have to plant the seed.

That's as true of South Carolina's crop of new farmers as it is the commodities their farms produce.

"We have to prepare new farmers to take the torch from previous generations," said Dave Lamie, an associate professor and Extension specialist in agribusiness in the Clemson University Institute for Economic and Community Development at the Sandhill Research and Education Center near Columbia.

"The nation's farm population is aging and fewer people are growing up in rural areas with farming experience," said Lamie, who directs the South Carolina New and Beginning Farmer Program. "Preparing the new crop of farmers to be successful is essential both to our food supply and to the state's economy."

The South Carolina Department of Agriculture estimates that agriculture and forestry combine to generate more than $34 billion a year in the state economy. But the most recent census from the National Agricultural Statistics Service lists the average age of South Carolina farmers at 59, higher than the national average by a year.

Just 11 percent of South Carolina farmers are under the age of 45. Nationally, there are five times as many farmers aged 75 or older than there are farmers 25 or younger.

"Agriculture has changed radically during the lives of today's farmers, and we've re-tooled our research and education programs to meet those changes," said George Askew, associate vice president for Public Service and Agriculture at Clemson. "When a farmer retires, he takes with him valuable experience. New farmers have to learn a lot in a short time. That's why we're reaching out with programs specifically for emerging farmers and start-up agribusinesses."

With that much on the line, it helps to start early. In Honea Path, straddling Abbeville and Anderson counties, the future of farming goes to school every day.

"We have a diversified program that exposes students to many different sides of agriculture," said Glenn Stevens, an agricultural education teacher at Belton-Honea Path High School who leads the Future Farmers of America chapter there. "More than half our students will go on to higher education in agriculture or a related field," Stevens said. "We're trying to expose them to the many different opportunities in agriculture and give them skills that will be important in the job market."

Many FFA students will enter traditional agriculture degree programs at Clemson. Some will pursue a new degree program, just begun this fall, specifically for agribusiness.

Not all new farmers come from high school and college ranks, however.

"There's no age limit on entering agriculture. In addition to young people entering the profession, we have a lot of adults who are looking at agriculture as a second career or as a retirement strategy. A number of them are looking to take advantage of increasing opportunities to create new markets for locally grown food," Lamie said.

"At whatever stage they enter the business, it's important to enter prepared, and it's important to our state that we keep agriculture productive" he said. "Our goal is to prepare the next generation of South Carolina farmers to be as successful as the one before them."

Learn more about the South Carolina New and Beginning Farmers Program: www.clemson.edu/ciecd/focus_areas/agribusiness/programs/newfarmer

Finishing touches

Brooke Shelton of Cleveland, Ga., readies her animal for competition in the Clemson University Spring Dairy Show Feb. 28, 2014 at the T. Ed Garrison Livestock Arena in Pendleton. The annual show involves registered Guernsey, Holstein, Jersey and Brown Swiss breeds as well as showmanship competition for 4-H and FFA students.

Learn more about Clemson youth livestock opportunities: www.clemson.edu/4h/kids_families/projects/agriculture_and_animals

Reviving *new* opportunity from *old* crops

By Tom Hallman

If everything old really is new again, then South Carolina can prepare for a revival of a pair of near-forgotten crops.

They're what Darlington County Extension agent Trish DeHond calls "the resurrected crops" – commodities with a proven pedigree that once profited producers and thrived in the Carolina climate. If not exactly household, their names intone a familiar flair: canola and milo.

"These are the comeback kids," DeHond says. "They're crops that have been grown here before. We have a track record with them. We've proved they grow well in our climate and soils and that we know how to produce successful yields. But until recently we haven't recently had a market for them."

No crop will survive long on the farm without a marketable purpose. In the case of these row crops, buyers have popped up in the coastal plain:

- Milo, or grain sorghum, is finding a market as feed for livestock producers like Murphy-Brown LLC, just across the state line in Warsaw, N.C. Sorghum, a more drought-tolerant alternative to corn, can be used as a feed for poultry, hogs or cattle on the farm as well.
- And just across the Savannah River in Bowersville, Ga., AgStrong LLC has built a crushing mill to process canola, an oilseed that – depending on its composition and processing – can be used either as a high-grade food oil in the kitchen or as an industrial lubricant.

"Each of them has its own niche at the moment, but people are watching them closely for their potential," DeHond said. "If either of them develops a strong market, we want South Carolina agriculture to be in a position to take advantage of it."

Both crops fit nimbly into the Palmetto State's climate. The drought-tolerance of grain sorghum is handy during hot summer moths, particularly on the sandier soils of the Pee Dee region.

Canola – typically grown in colder climes over the summer – is cultivated in the winter months in Southern states, allowing farmers to get more production revenue from each acre on the farm. Like winter wheat, canola pairs nicely with a summer crop of soybeans.

Canola has an added benefit, DeHond said: Most of the equipment needed to tend and harvest it already sits in the average row-crop farmer's barn.

"It's about the same work as wheat," said Johnny Tedder, a Darlington County farmer who grows 200 acres of canola for AgStrong. "I have a little more money in it (than in his wheat crop), but it's easy to cut with the combine."

Shortly after its development in Canada in the 1970s, Southern farmers experimented with canola briefly, but the market for it wasn't sustained.

"We had a lot of growers who grew it back then, and some might have a bit of a bitter taste in their mouths having lost that market before," DeHond said. "It's all about making money. Farmers want crops that they can grow and sell. But a lot has happened since then. I think 'cautious optimism' is the watchword now."

From the buyer's point of view, the optimism is enthusiastic.

"From 20 years ago, the technology has just exploded," said Mike Garland of AgStrong, who works with growers who contract with the company to grow canola. "This is the one of those times when Carolina agriculture can do it better. We can double the crop and get twice the yield of the Canadians.

"As a grad student I was excited about soybeans, but I've never been as excited about a crop as I am canola. It's the right thing to do," said Garland, a Hartsville, S.C., native who began his career as a soybean breeder in Iowa. "I want to be remembered for coming back from the Midwest to establish a new winter crop for my home."

If the market strengthens and South Carolina farmers increase their acreage, Clemson Extension grains specialist David Gunter intends to be prepared.

Gunter is putting varieties of canola to the test in plots at the Pee Dee Research and Education Center near Florence to ensure that Clemson Extension has reliable recommendations for achieving the best yields and controlling pests of the plant.

"The question is which will perform better here, the spring or winter varieties. South Carolina is right on that break line," he said. "What you want is to get away from is that freeze loss. If the flower freezes, nothing pollinates."

South Carolina's unpredictable winter weather reared its head in the trials, but Gunter has high hopes for a type called Flint, which he calls "an old stand-by variety."

"Normally this comes off earlier than the wheat, so you can get your beans in or even plant cotton behind it," he said. "We need something more like a normal winter to get some reliable results. But if more farmers make the decision to go with canola, we'll be ready."

Learn more about the Pee Dee Research and Education Center:
www.clemson.edu/public/rec/peedee/

Partner joins Clemson to expand food-supply resource MarketMaker

By Peter Hull

A new partner has joined Clemson to expand its information technology supporting statewide, national and international agriculture development.

Riverside Research, a not-for-profit company chartered to advance scientific research in the public interest, recently signed a global licensing agreement with the University of Illinois at Urbana-Champaign for the exclusive rights to MarketMaker, a web-based information and communication resource designed to revolutionize the food supply chain.

Clemson and its partner organizations will continue to contribute industry expertise, build relationships with growers and buyers throughout South Carolina and offer unlimited and free access to the S.C. MarketMaker portal.

MarketMaker is one of the largest databases of searchable, food industry-related information in the country, currently linking producers and consumers in 19 states and the District of Columbia.

South Carolina food producers -- farmers, ranchers, agritourism sites, farmers markets, community-supported agriculture groups, food banks and others -- can use the site to discover and connect with local buyers and consumers.

The site also provides market research data and search functionality to help farmers identify potential markets for specialty crops. As the exclusive licensee, Riverside Research plans to invest in additional research and development to expand MarketMaker's capabilities to new markets and regions, both nationally and globally.

"The company has great experience and expertise in information systems, a longstanding commitment to the greater good and a high-integrity business culture. These qualities are critical to the future expansion of MarketMaker and realizing its great potential to fight world hunger," said Dave Lamie of the Clemson Institute for Economic and Community Development, who leads MarketMaker in South Carolina.

Learn more about the South Carolina MarketMaker program:
www.clemson.edu/ciecd/focus_areas/agribusiness/programs/marketmaker

Bulls draw record prices in Clemson test

By Rebecca Dalhouse

Dusty boots, tipped-back cowboy hats and high expectations ringed the red corral for auction day at the annual Clemson University Bull Test.

To the mesmerizing chant of the auctioneer, each of 55 bulls strutted through the freshly saw-dusted corral. As one galloped out, another one trotted in, their black coats glistening under fluorescent lights.

Having completed 112 days in a feedlot test, the bulls garnered a record-setting $2,975 average price in the auction at Clemson's T. Ed Garrison Livestock Arena.

"From top to bottom, I think this is one of the best sets of bulls we have had in several years," said Matthew Burns, Clemson Extension beef specialist and test manager.

The Clemson Bull Test, conducted Jan. 31 at the university's Simpson research station, gives South Carolina cattle producers valuable insight into how efficiently each bull gains weight.

"An efficient bull is one who gains a lot of weight quickly on the least amount of feed," Burns said, explaining that this trait is passed along to the bull's offspring.

Feed is one of cattle producers' largest expenses. The more weight cattle gain on a single pound of feed, the more profit they yield.

Burns uses an electronic monitoring system that tracks each bull's feed intake during the test and then shares the data with national breed associations after the test. The Clemson test is one of only a few in the country to collect this kind of data, which is used to create feed-conversion standards for different breeds.

"At the sale, buyers base their selections on these numbers, which are all listed next to each bull in the sale catalog," Burns said. "The test compares bulls in the same age group and breed, so we get a clear picture of what to expect."

This data is especially important in a state like South Carolina, where most cattle herds are relatively small and cattle producers are focused on breeding calves rather than raising cattle for slaughter.

Small farms typically don't have the resources to conduct such research, making the Clemson data more valuable to Palmetto State producers looking to raise high-quality breeding stock.

Learn more about the Clemson Bull Test:
www.clemson.edu/extension/livestock/beef/bulltests-cubt

Researchers monitor salinity and vegetation in Savannah River wetlands

By Jonathan Veit

Wetland ecologists at the Belle W. Baruch Institute of Coastal Ecology and Forest Science will spend the next year monitoring water salinity levels and vegetation changes at sites in and around the Savannah National Wildlife Refuge.

Clemson researcher Jamie Duberstein and his team will install recorders programmed to measure salinity at various depths at hourly intervals, sample vegetation along transects that extend into the heart of the marshes and incorporate satellite imagery as part of a GIS mapping analysis.

They will collect the data at 12 sites located 26 to 30 miles upriver from Fort Pulaski, where the Savannah River Estuary meets the Atlantic Ocean.

The research is part of a program designed to evaluate environmental impacts resulting from the Savannah Harbor Expansion Project. It is supported by $360,000 in funding from the U.S. Army Corps of Engineers.

The Corps will use the data as a baseline for monitoring the effectiveness of modifications it will make to upper-harbor tidal creeks to alleviate the potential environmental impact of deepening the harbor, including minimizing impact to ecologically unique freshwater tidal wetlands.

"The data we collect will allow the Corps to understand if, after construction of the project, the flow rerouting and other mitigation features are working as intended," Duberstein said.

The Corps will divert more freshwater into the Back River to minimize the impact of increased salinity in the estuary. Without the mitigation in place, the Corps anticipates 1,117 acres of freshwater tidal wetlands would convert to brackish marsh. With the flow rerouting in place, the Corps anticipates that 223 acres will be converted. Additionally, 740 acres of salt marsh are anticipated to convert to brackish marsh, according to the Corps studies.

The Corps will mitigate the remaining impact by acquiring and preserving 2,245 acres of freshwater wetlands for the Savannah National Wildlife Refuge at an estimated cost of $12.4 million. The harbor deepening project would acquire lands that the refuge identified as being valuable additions to the habitats they manage, and then transfer ownership of those properties to the U.S. Fish and Wildlife Service.

"We are losing freshwater marshes along the East Coast; and the Savannah River contains intact marshes that are environmentally important. We need to keep these marshes as much freshwater as possible so this diverse system doesn't become monolithic. Plant life, wildlife and fisheries would all be negatively impacted by high salinity," Duberstein said.

Learn more about the Belle W. Baruch Institute of Coastal Ecology and Forest Science: www.clemson.edu/baruch

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Baruch, Yawkey Wildlife Center join forces in coastal ecology research

By Jonathan Veit

Improving the management of coastal wildlife and natural resources is the goal of a new research partnership involving Clemson's Belle W. Baruch Institute of Coastal Ecology and Forest Science, the South Carolina Department of Natural Resources' Tom Yawkey Wildlife Center and the Yawkey Foundations.

Clemson faculty and students will participate in collaborative research into coastal resources management and share research findings with natural resources professionals, decision-makers and stakeholders throughout South Carolina and the nation.

"Given their geographical proximity and aligned interests, it makes perfect sense for Clemson's Baruch Institute and the Yawkey Center to collaborate on wildlife and natural resources research," said Skip Van Bloem, forest ecologist and Baruch Institute director. "The collaboration will contribute to more efficient and sustainable coastal conservation."

The Baruch Institute is located on 17,500 acres near Georgetown and is dedicated to research and outreach focused on the ecology and management of the natural resources of coastal South Carolina.

The Yawkey Center consists of North, South and Cat Islands and encompasses 24,000 acres. The property with its diverse habitats, including salt marshes, managed wetlands, wildlife openings, ocean beaches, longleaf pine uplands and maritime forests, is dedicated as a wildlife preserve and waterfowl refuge, and a research and education center.

Learn more about the Belle W. Baruch Institute of Coastal Ecology and Forest Science: www.clemson.edu/baruch

Food 2 Market

A program that lives up to its label

By Tom Hallman

Your mama's jam. Grandma's chow-chow. Daddy's secret barbecue sauce.

Can't you just savor the flavor?

And don't you reckon others would pay for the privilege?

Don't break out the Mason jars just yet. Before you can turn your recipe into a business, you'd better be iron-clad certain it's safe – and legal.

Meet Kimberly Baker.

"There are a lot of people who cook really well, who have a product and want to sell it. Their friends keep telling them they should do more than just bring it to the church and the family reunion," said Baker, a Clemson Extension food safety associate.

"They may have a great idea, but they need some help navigating the regulations that apply to food safety," she said. "That's what we do."

Baker runs Clemson's Food2Market program, a quiltwork of classes, training material, personal advice and scientific tests to help newcomers learn the ropes and safely move their food products to consumers.

Food2Market is designed to reach what Baker calls "food entrepreneurs" – newcomers who bring energy, creativity and vitality to the marketplace. Baker just wants to be certain they don't also bring botulism.

"Foods that do not meet certain specifications can encourage the growth of bacteria which can cause people to get sick," Baker said. "Federal and state laws specify conditions that products have to meet for safety purposes. It's important to have your food product tested to be sure it meets those criteria."

Food2Market helps steer food entrepreneurs through the sometimes confusing macramé of regulations and the agencies responsible for them. It covers everything from manufacturing process controls to requirements for package labels.

Not all food entrepreneurs are exactly newbies. Sometimes newcomers have a lifetime of experience.

"We get a lot of retired people or people who have already had a career in one field and are looking to make a change," Baker said. "Even for the experienced, there's often a lot to learn."

Among the experienced is Steve Perone, whose father Vince began a famous Upstate restaurant business by selling sandwiches for a quarter at Furman University, where he played and coached football in the 1950s.

"I've considered packaging some of my dad's sauces," Perone said at a recent Food2Market meeting in Columbia. "Producing and marketing packaged foods is a great deal different from the restaurant business. I came here to learn as much as I could, and it's a great experience."

"There's no better example of capitalism than food entrepreneurs. If you have a great idea you have to develop it, produce it, market it and put it in the hands of the people who want it," South Carolina Agriculture Commissioner Hugh Weathers told attendees at the Columbia workshop. "That's why I'm excited to see people like this getting the support they need from the experts. The cooperation among agencies to help these people is excellent."

Cooperation is key in the food business, which must meet requirements from USDA, FDA, state and even local governments, said Julie Northcutt, a Clemson professor of food, nutrition and packaging sciences.

"Food has to be handled properly from harvest to consumption to ensure its safety," she said, rattling off names of potential food pathogens responsible for an estimated 48 million cases of foodborne illness in the United States each year: salmonella, norovirus, campylobacter, toxoplasma, listeria, Clostridium perfringens and Escherichia coli O157:H7 – known by the more familiar alias, E. coli.

The Food and Drug Administration and the state agriculture department require testing for certain products that have a potential risk for growing harmful bacteria. The Food2Market program offers testing for some products to meet those requirements, including tests for pH, water activity and nutritional analysis.

Food products that will be stored without refrigeration require pH testing. If the product has high sugar content, a water activity test may also be required. The results of these tests will determine whether the product requires additional registration.

"Products that are classified as acidified and low-acid require processors to register their facilities and processes with the Food and Drug Administration," Baker said.

"This is a requirement of the FDA and must be done before registering the product with the South Carolina Department of Agriculture."

Clemson also offers a a Better Process Control School, which provides certification for food processors dealing with acidification, thermal processing and container closure.

The certification and product testing results are included in documentation to show state and federal authorities that requirements are met.

"It's not just a good cook who makes a food entrepreneur," Baker said. "You're a manufacturer. You're the marketing person. You're the salesman. You're the one to find the equipment, buy the ingredients, follow the regulations, buy the insurance.

"Some will pay off, while the majority never make it to the top. The important thing is to know why you're in the business to start with," she said. "For a lot of them, they're happy selling at the farmers market in the peak of the season. That's enough. Others need a little supplemental income, so they set out to generate a few thousand dollars a year. It all comes down to what the entrepreneur considers success."

Learn more about Food2Market:
www.clemson.edu/extension/food2market

Foodborne ILLNESS in the US

More than **20%** of foodborne illness outbreaks result from food that was consumed in the home. Contributing factors include improper food storage, handling and preparation.

1/6 Americans become **SICK** with food-related illnesses each year

OR nearly the population of these states combined

128,000

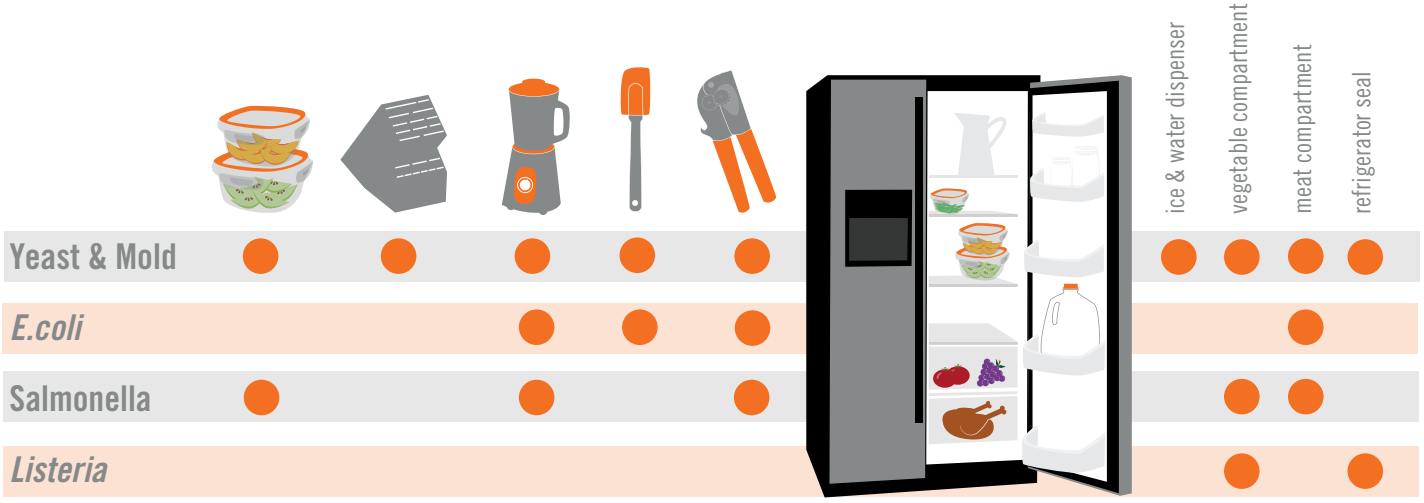
Americans are **HOSPITALIZED** each year from food-related illnesses

3,000

Americans **DIE** each year from food-related illnesses

Is YOUR kitchen making you sick?

In 2013, NSF International conducted an international germ study and tested 14 common kitchen items for *E. coli*, Salmonella, yeast and mold, and *Listeria*.

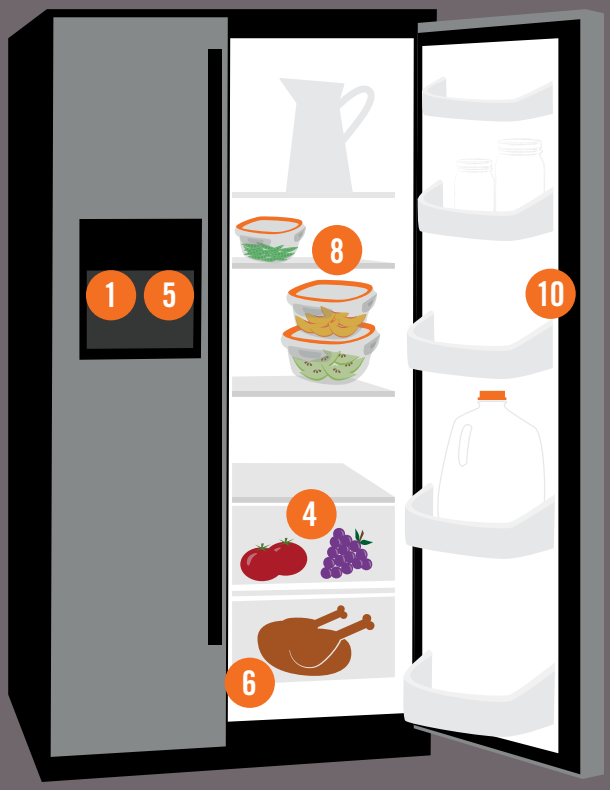


100% of the items tested positive for **yeast & mold** and these 6 items tested at **concerning levels**: refrigerator vegetable compartment, rubber spatula, blender gasket, refrigerator ice & water dispensers, and the rubber seal on a food storage container.

Donna Bowen and Walker Massey

Top 10 GERMIEST kitchen items

HALF of the germiest kitchen items are found in one single kitchen appliance - the refrigerator !



1. Refrigerator water dispenser
2. Rubber spatula
3. Blender
4. Refrigerator vegetable compartment
5. Refrigerator ice dispenser
6. Refrigerator meat compartment
7. Knife block
8. Food storage container with rubber seal
9. Can opener
10. Refrigerator insulating seal

Follow these steps to remove dirt & debris and reduce germs to a safe level.

CLEAN

Remove & empty bins from the refrigerator.

Unplug electric items.

Remove gaskets, seals & washable parts from blender, can opener, rubber spatulas & storage containers.

RINSE

Remove knives from the knife block.

Thoroughly wash all items with warm soapy water and rinse with clean water.

DRY

Dry with a clean towel or paper towel.

SANITIZE

Sanitize by spraying a mixture of 1 tablespoon chlorine bleach (6%) to 1 gallon of water.

Let chlorine mixture remain on items for 1 minute.

Air dry or wipe dry with a clean paper towel.

sources

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CLEMSON COOPERATIVE EXTENSION

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